1. Compute the sum of the reciprocals of 3, 5, 7, 9, … , 63.

```
listreciprocals = Table[1/i, {i, 3, 63, 2}]
```

$\left\{\frac{1}{3}, \frac{1}{5}, \frac{1}{7}, \frac{1}{9}, \frac{1}{11}, \frac{1}{13}, \frac{1}{15}, \frac{1}{17}, \frac{1}{19}, \frac{1}{21}, \frac{1}{23}, \frac{1}{25}, \frac{1}{27}, \frac{1}{29}, \frac{1}{31}, \frac{1}{33}, \frac{1}{35}, \frac{1}{37}, \frac{1}{39}, \frac{1}{41}, \frac{1}{43}, \frac{1}{45}, \frac{1}{47}, \frac{1}{49}, \frac{1}{51}, \frac{1}{53}, \frac{1}{55}, \frac{1}{57}, \frac{1}{59}, \frac{1}{61}, \frac{1}{63}\right\}$

```
Total[listreciprocals]
```

$\frac{31\,674\,468\,729\,962\,723\,297\,623\,231}{18\,472\,920\,064\,106\,597\,929\,865\,025}$

2. Compute $\frac{1}{1+\frac{1}{1+\frac{1}{1+\frac{1}{2}}}}$

```
convergentlist = Convergents[{0, 1, 1, 1, 2}];
Last[convergentlist]
```

$\frac{5}{8}$

3. Obtain a 50 digit approximation to $\sqrt{\pi}$

```
N[Sqrt[Pi], 50]
```

1.7724538509055160272981674833411451827975494561224

4. Use the Table function to make a list of the 30 prime numbers starting with 11 and ending with 139. Name the list P.

```
Solve[Prime[x] == 11, x]
```

{{x → 5}}

```
Solve[Prime[x] == 139, x]
```

{{x → 34}}

```
p = Table[Prime[i], {i, 5, 34}]
```

{11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97, 101, 103, 107, 109, 113, 127, 131, 137, 139}

5. Add the numbers in the sequence P found in question 4.

```
Total[p]
```

2110

6. Multiply the numbers in the list P found in question 4. Then get a count of the number of digits in the product.

```
lengthp = Length[p]
```

30

```
productp = Product[p[[i]], {i, 1, lengthp}]
```

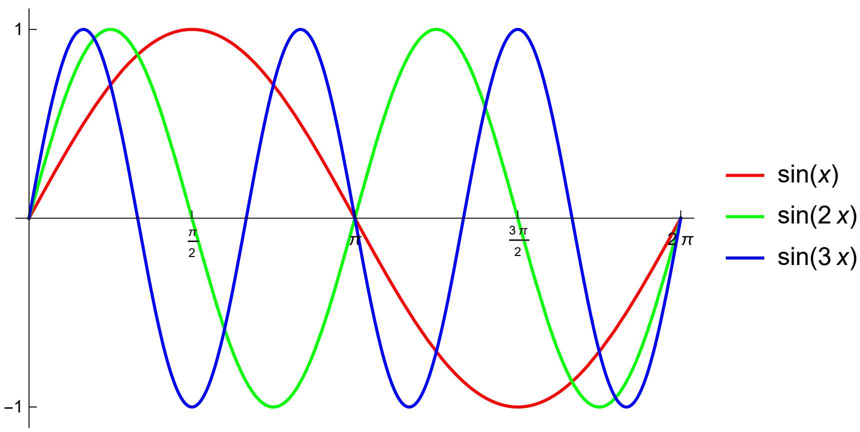
47 688 793 574 281 857 464 329 681 579 285 428 844 601 593 586 668 729

```
IntegerLength[productp]
```

53

7. Sketch the graphs of y = sin [x], y = sin [2x], and y = sin [3x], $0 \leq x \leq 2\pi$ in steps of $\pi/2$, on one set of axes. Use different colors for each curve.

```
Plot[{Sin[x], Sin[2 x], Sin[3 x]}, {x, 0, 2 Pi}, PlotStyle → {Red, Green, Blue},
 PlotLegends → "Expressions", Ticks → {{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {-1, 1}}]
```



8. Make a list of the cubes of the integers 2, 5, 6, 9, 12, 44. Add the numbers in the list of cubes and then display the prime factorization of the sum. What do you notice about the prime factorization?

```
f[x_] := x^3
```

```
cubeslist = Map[f, {2, 5, 6, 9, 12, 44}]
```

{8, 125, 216, 729, 1728, 85 184}

```
Total[cubeslist]
```

87 990

```
FactorInteger[Total[cubeslist]]
```

{{2, 1}, {3, 1}, {5, 1}, {7, 1}, {419, 1}}

All prime factors appear only once.

9. Obtain the prime factorization of the product of the integers in the list of cubes described in Exercise 8.

```
FactorInteger[Product[cubeslist[[i]], {i, 1, 6}]]
```

```
{{2, 18}, {3, 12}, {5, 3}, {11, 3}}
```

10. Find two ways to find an approximate value of x for which 2^x= 100 . Display the solution in a graph

- Method 1

```
NSolve[2^x - 100 == 0, x, Reals]
```

```
{{x → 6.64386}}
```

- Method 2

```
Log[2, 100.]
```

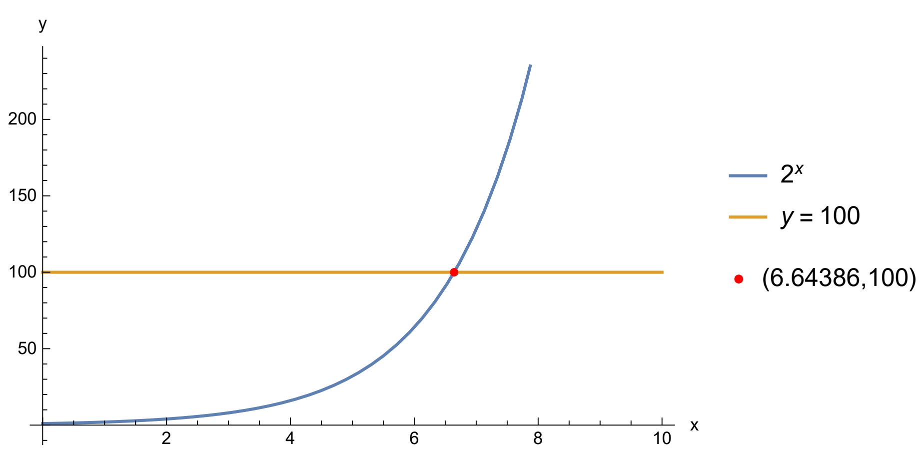
```
6.64386
```

- Graph

```
pointten = ListPlot[{{6.64386, 100}}, PlotStyle → Red, PlotLegends → {"(6.64386,100)"}];

plotten =
  Plot[{2^x, y = 100}, {x, 0, 10}, AxesLabel → {"x", "y"}, PlotLegends → "Expressions"];

Show[plotten, pointten]
```



11. What is the 115th Fibonacci number? What is the 1,115th Fibonacci number?

```
Fibonacci[115]
```

```
483 162 952 612 010 163 284 885
```

```
Fibonacci[1115]
```

46 960 625 891 577 894 920 915 085 010 622 289 470 462 518 359 149 677 075 881 383 631 822 660 890 718 642 869 603 700 018 836 567 361 824 279 444 479 341 088 310 462 978 732 670 769 895 389 845 153 583 927 059 046 832 024 176 024 794 070 671 098 298 816 588 315 827 802 770 672 734 166 457 585 412 100 971 385

12. What are the greatest common divisor and least common multiple of 5,355 and 40,425?

```
GCD[5355, 40425]
```

105

```
LCM[5355, 40425]
```

2 061 675

13. Find two ways to compute the sum of the squares of the first 20 consecutive positive integers.

- Method 1

```
squareslist = Table[i^2, {i, 1, 20}]
```

{1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, 256, 289, 324, 361, 400}

```
Total[squareslist]
```

2870

- Method 2

```
Sum[x^2, {x, 0, 20}]
```

2870

14. Find the first three positive solutions to the equation cos(x) = x tan(x). Display your solutions in a graph.

```
FindRoot[Cos[x] == x * Tan[x], {x, 1}]
```

{x → 0.760807}

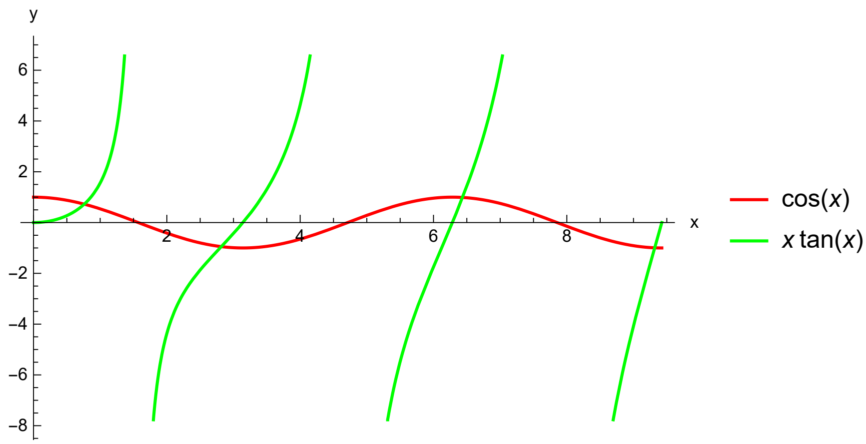
```
FindRoot[Cos[x] == x * Tan[x], {x, 2}]
```

{x → 2.81704}

```
FindRoot[Cos[x] == x * Tan[x], {x, 6}]
```

{x → 6.43558}

```
Plot[{Cos[x], x * Tan[x]}, {x, 0, 3 Pi}, PlotStyle → {Red, Green},
 AxesLabel → {"x", "y"}, PlotLegends → "Expressions"]
```



15. Evaluate $\left(\frac{1}{1}+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}\right)+\left(\frac{2}{1}+\frac{2}{2}+\frac{2}{3}+\frac{2}{4}\right)+\left(\frac{3}{1}+\frac{3}{2}+\frac{3}{3}+\frac{3}{4}\right)$

- Method 1

```
listfourreciprocals = {1/1, 1/2, 1/3, 1/4}
```

$\left\{1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}\right\}$

```
6 * Total[listfourreciprocals]
```

$\frac{25}{2}$

- Method 2

```
1/1 + 1/2 + 1/3 + 1/4 + 2/1 + 2/2 + 2/3 + 2/4 + 3/1 + 3/2 + 3/3 + 3/4
```

$\frac{25}{2}$